*Journal of the American Foundrymen's Association.*

VOL. X. DECEMBER, 1901. PART II

# MELTING LOSS IN THE CUPOLA PROCESS.

## PROCEEDINGS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

Your Secretary begs to report the results of the recent inquiry into the melting loss incident to the Cupola process. It will be remembered that the following information was asked for: The class of work and usual tonnage. Time from "blast on" to "drop bottom," with blast pressure from fan or blower. The kind of fuel used, also pig iron, whether charcoal or coke, and the percentage of Southern brands. The kind of scrap bought. Then the weights of pig iron and scrap charged, and castings and scrap made. The last named items were necessary to figure the melting losses, and the other material to interpret the results intelligently. The name of the foundries sending this information was to be kept confidential, and your Secretary hereby conveys the thanks of the Association to its friends for their courtesy, and states that after the tables annexed were constructed the memoranda sent in were destroyed.

Of the many replies, which came even from Europe, only forty-one could be used, as the information was not definite enough; others again had their material from the cupola equal to that going in, which manifestly indicates overzealousness on the part of the weighers. Only the best records seem to have been sent in, as surprisingly low losses are to be chronicled in many cases. Nevertheless, apart from possible errors in weighing, the records are certainly valuable, as it is perfectly possible to melt clean iron and scrap with melting losses running below 5 per cent. In fact your Secretary has individual knowledge of one of the heaviest producers of car wheels in the country, taking their stock books all the year round, where the actual melting loss is less than 2 per cent. Here we see the value of

clean, unoxidised irons, scrap which is not rusty, and a well constructed cupola in good working order.

The information received was tabulated in such a way that the interested founder can turn at once to the results he wants most.

TABLE I.—GENERAL JOBBING.

| | NUMBERS | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Usual Tonnage..... | 10 | 3 | 3 | 3 | 20 |
| Time of Melting; hrs , mins., | 1′ 15″ | 1′ 00″ | 1′ 15″ | 2′ 0″ | ..... |
| Blast pressure, oz,..... | 8 | ..... | ..... | 8 | 8 |
| Fan or Blower,..... | F | F | F | B | F |
| Pig Iron,..... | Coke | Coke | Coke | Coke | ..... |
| % Southern, ..... | None | ..... | None | None | ..... ... |
| Fuel used,..... ..... | Coke | Coke | Coke | Coke | ..... |
| Scrap bought,..... | Mach. | Med. Mach | Mach. | Stove | Mach. |
| Pig Iron used, lbs..... | 10,400 | 3,200 | 2,657 | 2,685 | 20,000 |
| Scrap used,..... ... | 9,600 | 3,200 | 2,886 | 3,885 | 20,000 |
| Castings made, ..... | 16,495 | 5,504 | 3,916 | 4,057 | 35,200 |
| Scrap made,..... | 1,352 | 620 | 872 | 1,873 | 2,200 |
| % Melting loss,..... | 10.7 | 4.3 | 13.6 | 9.7 | 6.5 |

Note—No. 3 is average of 10 heats.

Nos. 2 and 3 seem to represent the extremes in this table, and strange to say, in each case about half pig and half scrap is in the mixture. It is possible that the diameter of the cupola may give a clue to the great difference, or yet the scrap in No. 3 may be very dirty. The table is a good representation of the

general jobbing trade, a small, medium, and heavy tonnage being shown.

TABLE II—LIGHT JOBBING.

| | NUMBERS | | | |
|---|---|---|---|---|
| | 6 | 7 | 8 | 9 |
| Usual Tonnage,..... | 72 | 6 | 16 | 2.5 |
| Time or Melting, hrs., mins.,... | 3′ 30″ | 1′ 30″ | 2′ 30″ | 1′ 00′ |
| Blast pressure, oz.,..... | 13 | 6.5 | ..... | ..... |
| Fan or Blower, ..... | B | F | F | F |
| Pig Iron,..... | Coke | Coke | Coke | Coke |
| % Southern,..... | None | ..... | None | None |
| Fuel used,..... | Coke | Ck. & Coal | Coke | Coke |
| Scrap bought,..... | ..... | Stove | Lt. Mach. | Med. Mach |
| Pig Iron used, lbs.,..... | 102,000 | 4,500 | 19,200 | 3,200 |
| Scrap used,..... | 42,000 | 7,500 | 12,800 | 1,800 |
| Castings made,..... | 108,300 | 10,300 | 21,000 | 4,000 |
| Scrap made, ..... | 27,500 | 1,200 | 9,100 | 800 |
| % Melting loss,..... | 5.7 | 2.7 | 6.0 | 4.0 |

No. 6 is an example of heavy tonnage, and No. 9, on the oth-

er hand, of a very light one. The results are all good.

TABLE III—LIGHT MACHINERY.

| | NUMBERS | | | | | |
|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 13 | 14 | 15 |
| Usual Tonnage,.... | 10 | 6 | 3.5 | 5 | 15 | 40 |
| Time of Melt., h. m., | 1′ 10″ | 2′ 0″ | 1′ 30″ | 1′ 30″ | 2′ 00″ | 6′ 40″ |
| Blast pressure, oz., | ..... | ..... | 7 | 5 | 7 | ..... |
| Fan or Blower, .... | F | F | B | F | B | F |
| Pig iron, ..... | Coke | C'k & C'l | Coke | Coke | Coke | Coke |
| % Southern,..... | ..... | ..... | None | 50 | 35 | 50 |
| Fuel used,..... | C'k & C'l | Coke | Coke | C'k & C'l | Coke | Coke |
| Scrap bought,..... | None | Med M'ch | L't Mach | Med M'ch | Lt. Mch | Stove |
| Pig iron used, lbs.,. | 16,000 | 6,000 | 3,900 | 4,500 | 14,000 | 56,000 |
| Scrap used..... | 4,000 | 6,000 | 2,750 | 4,280 | 16,000 | 24,000 |
| Castings made, .... | 13,220 | 10,000 | 3,738 | 7,640 | 20,500 | 60,000 |
| Scrap made,..... | 4,520 | 000 | 2,762 | 800 | 6,000 | 16,000 |
| % Melting loss,..... | 6.5 | 9.2 | 2.3 | 3.9 | 11.6 | 5.0 |

Here we have a record of Southern iron used. The point was raised by one foundryman that whenever he used Southern irons the melting loss was increased by about one per cent. Nos. 13 and 15 do not seem to bear this out, and very probably the experience above mentioned may be traced to the use of Southern irons high in Silicon. These would offer plenty of material to burn out. Possibly No. 14 is an example of this kind. Where coke and coal are given as the fuels used, the practice varies from an Anthracite bed with subsequent charges of coke, to practically all Anthracite, or at least only enough coke to effect a noticeable separation of the successive charges. Now and then we find charcoal irons on the list. It may also be observed that

the positive blower is very much in evidence, and that the blast pressures run quite high. As the tables really explain themselves, they follow without further comment.

TABLE IV—HEAVY MACHINERY.

| | NUMBERS | | | |
|---|---|---|---|---|
| | 16 | 17 | 18 | 19 |
| Usual Tonnage, | 13 | 15 | 21 | 15 |
| Time of Melt., hrs. min., | 2′ 0″ | 2′ 0″ | 4′ 00″ | 2′ 00″ |
| Blast Pressure, oz., | 6 | 10 | 9 | 14 |
| Fan or Blower, | B | B | B | B |
| Pig Iron, | Coke | Coke | C'k & Ch | Coke |
| % Southern, | 50 | 70 | 17 | 20 |
| Fuel Used, | Coke | Coke | Coke | Coke |
| Scrap bought, | Mach. | Hvy Mch | Mach. | ..... |
| Pig iron used, lbs. | 14,720 | 20,000 | 25,740 | 15,500 |
| Scrap used, | 11,130 | 10,000 | 16,270 | 11,500 |
| Castings made, | 18,845 | 21,300 | 32,760 | 19,000 |
| Scrap made, | 4,870 | 7,200 | 7,560 | 6,000 |
| % Melting loss | 8.4 | 5.0 | 4.0 | 7.4 |

TABLE V—STOVE PLATE.

| | NUMBERS | | |
|---|---|---|---|
| | 20 | 21 | 22 |
| Usual Tonnage, | 20 | 15 | 10 |
| Time of Melt., hrs. min., | 2′ 15″ | 1′ 30″ | ..... |
| Blast Pressure, oz., | 14 | 11 | 13 |
| Fan or Blower, | B | ..... | B |
| Pig Iron, | Coke | Coke | Coke |
| % Southern, | 100 | 50 | 25 |
| Fuel used, | C'k, & C'l. | Coke | C'k. & C'l. |
| Scrap bought, | Stove | Stove | ..... |
| Pig iron used, lbs. | 20,000 | 18,000 | 11,863 |
| Scrap used, | 20,000 | 12,000 | 7,906 |
| Castings made, | 24,000 | 20,192 | 11,750 |
| Scrap made, | 14,200 | 9,000 | 7,629 |
| % Melting loss, | 4.5 | 2.7 | 2.0 |

Note—No. 22 is average of 5 heats.

## TABLE VI—SANITARY WARE.

| | NUMBERS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Usual Tonnage, | 12 | 22 | 38 | 16 | 25 | 26 | 40 | 23 |
| Time of Heat, hrs. min., | 2′ 00″ | 3′ 15″ | 3′ 15″ | 2′ 30″ | 3′ 45″ | 3′ 45″ | 3′ 45″ | 3′ 00″ |
| Blast Pressure, oz., | 5 | 14 | 14 | 5 | 14 | ..... | 5 | ..... |
| Fan or Blower, | F | B | B | F | B | B | F | B |
| Pig Iron, | Coke | Coke | Coke | Coke | Coke | Coke | Coke | Coke |
| % Southern, | None | ..... | 60 | ..... | ..... | ..... | None | ..... |
| Fuel used, | C'k & C'l | Coke | Coke | C'k. & Coal | Coke | Coke | C'k, & Coal | Coke |
| Scrap bought, | Medium | ..... | None | Med Mach | None | ..... | Medium | None |
| Pig iron used, lbs., | 11,800 | 51,000 | 56,000 | 9,875 | 31,470 | 33,000 | 35,560 | 29,000 |
| Scrap used, | 12,200 | 12,000 | 20,000 | 22,625 | 17 760 | 19,850 | 47,210 | 17,500 |
| Castings made, | 17,228 | 46,660 | 51,614 | 23,276 | 35 ,956 | 37,250 | 59,400 | 33,385 |
| Scrap made, | 6,048 | 12,234 | 18,386 | 8,055 | 11,270 | 11,300 | 21,960 | 11,500 |
| % Melting loss, | 3.0 | 6.5 | 7.9 | 3.6 | 4.1 | 8.0 | 1.7 | 3.5 |

## TABLE VII—AGRICULTURAL.

| | NUMBERS | | | | |
|---|---|---|---|---|---|
| | 31 | 32 | 33 | 34 | 35 |
| Usual Tonnage, | 80 | 45 | 41 | 9 | 9.5 |
| Time of Heat, hrs. min., | 4′ 20″ | 3′ 15″ | 3′ 30″ | 2′ 00″ | 1′ 20″ |
| Blast Pressure, oz., | 16 | 12 | 13 | 12 | 9 |
| Fan or Blower, | B | B | B | B | B |
| Pig Iron, | Coke | Coke | Coke | Coke | Coke |
| % Southern, | 50 | ..... | 50 | 50 | None |
| Fuel used, | Coke | Coke | Coke | C'k & C'l | C'k & C'l |
| Scrap bought, | Agr No. 1 | Agr No. 1 | Med M'ch | Stove | Stove |
| Pig iron used, lbs. | 80,000 | 45,000 | 45 700 | 7,071 | 7,500 |
| Scrap used, | 80,000 | 45,000 | 35,800 | 10,674 | 11,600 |
| Castings made, | 108,800 | 61,200 | 62,960 | 11,845 | 7,450 |
| Scrap made, | 42,700 | 24,300 | 15,600 | 5,200 | 10,650 |
| % Melting loss, | 5.3 | 5.0 | 3.6 | 4.0 | 5.3 |

## TABLE VIII—RAILROAD CASTINGS.

| | NUMBERS | | |
|---|---|---|---|
| | 36 | 37 | 38 |
| Usual Tonnage, | 47 | 32 | 6.5 |
| Time of Heat, hrs. min., | 5′ 20″ | 3′ 45″ | 2′ 00″ |
| Blast Pressure, oz., | 16 | 4 | 9 |
| Fan or Blower, | B | F | ..... |
| Pig Iron, | Coke | Ch. & coke | Coke |
| % Southern | None | 60 | None |
| Fuel used, | Coke | Coke & coal | Coke |
| Scrap bought, | None | None | ..... |
| Pig iron used, lbs. | 66,500 | 25,000 | 6,765 |
| Scrap used, | 28,500 | 39,000 | 6,235 |
| Castings made, | 60,400 | 54,000 | 10,000 |
| Scrap made, | 28,700 | 7,500 | 2,385 |
| % Melting loss, | 6.1 | 3.9 | 4.7 |

Note—No. 37 is average of 27 Heats.
No. 38 is average of 25 Heats.

TABLE IX—FLOOR PLATES, GRATE BARS, ETC.

| | NUMBERS | |
|---|---|---|
| | 39 | 40 |
| Usual Tonnage,..... | 30 | 3 |
| Time of Heat, hrs. min.,..... | 3′ 40″ | 1′ 00″ |
| Blast Pressure, oz.,..... | 16 | ..... |
| Fan or Blower,..... | B | F |
| Pig Iron,..... | Coke | Coke |
| % Southern,..... | None | ..... |
| Fuel used..... | Coke | Coke & Coal |
| Scrap bought,..... | Medium Machine | Light Machine |
| Pig iron used, lbs.,..... | 20,000 | None |
| Scrap used,..... | 40,000 | 6,000 |
| Castings made,..... | 47,400 | 5,100 |
| Scrap made,..... | 8,200 | 525 |
| % Melting loss,..... | 7.3 | 6.2 |

TABLE X—CAR WHEEL.

| | NUMBER |
|---|---|
| | 41 |
| Usual Tonnage,..... | 200 |
| Time of Heat, hrs. min.,..... | 7′ 0″ |
| Blast Pressure, oz.,..... | 10 |
| Fan or Blower,..... | B |
| Scrap bought,..... | Wheel, |
| % Melting loss,..... | 2.1 |

*Journal of the American Foundrymen's Association.*

VOL. X. MARCH, 1902. PART II

# PROCEEDINGS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

## In Memoriam.

Whereas, It has seemed good in the eyes of an all-wise Providence, to remove from us by death, our well-beloved and honored President, John G. Sadlier.

Resolved, That while we bow to the will of Him who doeth all things well, we do deeply deplore the loss of our fellow member, and shall keenly miss his familiar face at our gatherings.

Resolved, That in his death we have lost from our number a most faithful friend and earnest worker. He was endeared to us by his kindly disposition and constant endeavor to raise his profession to a higher plane. The foundry trade of the country has lost one of its most thorough and earnest members, who will long be remembered with gratitude by a host of his former scholars, themselves most successful as the result of his example and teaching.

Resolved, That the Executive Board of the American Foundrymen's Association for and in behalf of the general membership hereby tenders the family and friends of the deceased the most heartfelt sympathy in their affliction.

THEO. H. COLVIN,
Senior Vice-President.

RICHARD MOLDENKE,
Secretary.

Announcement has already been made to our members of the tragic death of our President. Cut off in the full vigor of his active life by the bullets of an assassin, in his death he gave us another instance of fidelity to his trust even unto the end. Called from the dictation of a letter to your Secretary, which re-

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mained unsigned, only to face his Maker the next instant, it makes us feel as if his last effort was given to us. Moreover he had just written to those of our members who had resigned, asking them to reconsider their action, and urging the needs of our trade for unity of action and standardization of method as deserving of their continued support. May the hopes he had centered in our Association be realized in fullest measure, and we become as useful to our trade as he was to hundreds of struggling young men of whom he made efficient molders and useful citizens.

Besides personal letters of condolence written to Mrs. Sadlier, the above resolutions were adopted by your Executive Board, duly engrossed and forwarded with our sincere sympathy.

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## FURTHER CONTRIBUTIONS TO THE MELTING LOSS IN THE CUPOLA.

One of our members, interested in the criticisms which have appeared since the publication of the melting loss tables in our Journal, sends us the results of his large foundry, covering a period of one year. As the weights in this instance are for iron paid for, and castings sold, there is no doubt as to their correctness. The excellent results obtained simply prove that a founder may get a good economy if he watches every item carefully, as is done in this case to your Secretary's personal knowledge. Two classes of work are made in this foundry. General jobbing and car wheels.

### FOUNDRY COSTS.

Those of our Foundrymen who are accustomed to careful records in their works, in order to detect any possible leaks or insufficient economy will be interested in the following table showing the cost of 100 lbs. of castings made during the fiscal year ending June 1901. For obvious reasons no names are given.

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| Months | Cost of Materials Used. | | | | Salaries | Miscellaneous Expense | Cost per 100 lb. Castings | Weight of Good Castings | % Defective Castings |
|---|---|---|---|---|---|---|---|---|---|
| | Metals | Melting | Molding | Cores | | | | | |
| July | 0.7765 | 0.0509 | 0.0067 | 0 0156 | 0 4589 | 0.0526 | 1.3612 | 1.604.813 | 3 5 |
| August | 0.7489 | 0.0514 | 0 0082 | 0.0158 | 0.4693 | 0 0450 | 1.3386 | 1.535.295 | 3.7 |
| September | 0.7869 | 0 0496 | 0.0081 | 0.0156 | 0. 1540 | 0.0431 | 1.3573 | 1.744.708 | 2.8 |
| October | 0.8292 | 0.0456 | 0.0089 | 0.0168 | 0.4852 | 0.0695 | 1.4552 | 1.527.520 | 3.6 |
| November | 0 8483 | 0 0477 | 0.0081 | 0.0150 | 0.4821 | 0.0586 | 1.4598 | 1.471.152 | 2.3 |
| December | 0.8671 | 0.0457 | 0.0072 | 0.0158 | 0.4694 | 0.0954 | 1.5006 | 1.279,407 | 2.9 |
| January | 0.7921 | 0.0382 | 0.0091 | 0.0167 | 0.4915 | 0.0617 | 1.4093 | 1.334.866 | 2.5 |
| February | 0.7689 | 0.0366 | 0.0079 | 0.0154 | 0.4703 | 0.0556 | 1.3547 | 1.541,404 | 2.5 |
| March | 0.7496 | 0.0386 | 0,0081 | 0.0178 | 0.4861 | 0.0709 | 1.3711 | 1.314.192 | 3.3 |
| April | 0,7170 | 0.0380 | 0.0081 | 0.0164 | 0.4834 | 0.0503 | 1.3232 | 1.549.825 | 2.6 |
| May | 0.7076 | 0.0398 | 0.0085 | 0.0160 | 0 4748 | 0.0623 | 1 3090 | 1.408.797 | 2.1 |
| June | 0 6501 | 0.0358 | 0.0079 | 0.0157 | 0.4564 | 0.0460 | 1.2146 | 1.490,885 | 2.3 |
| Average | 0.7694 | 0.0436 | 0.0080 | 0.0161 | 0.4729 | 0.0583 | 1.3683 | 17.802,844 | 2.8 |
| " 1900 | 0.8479 | 0.0453 | 0.0072 | 0.0138 | 0 4550 | 0.0514 | 1.4206 | 21 965,408 | 2.2 |
| " 1899 | 0.4942 | 0.0380 | 0 0063 | 0.0123 | 0.4172 | 0.0417 | 1.0097 | 23 562,841 | 2.1 |
| " 1898 | 0.4589 | 0.0368 | 0.0062 | 0 0138 | 0.4346 | 0.0482 | 0.9985 | 20.117,909 | 2.5 |

COST PER 100 lbs. CASTINGS.

| | | |
|---|---|---|
| Average, 1897, 1.0866 | Average, 1892, 1.2892 | Average, 1887, 1.6900 |
| " 1896, 1.1469 | " 1891, 1.3457 | " 1886, 1.5600 |
| " 1895, 1.1332 | " 1890, 1.4611 | " 1885, 1.5900 |
| " 1894, 1.1442 | " 1889, 1.4842 | " 1884, 1.8200 |
| " 1893, 1.2687 | " 1888, 1.5320 | " 1883, 1.8700 |

A further very interesting contribution was received on this subject. It relates to the melting loss where burnt material is remelted.

(A) A selection of burnt grate bars, in fair condition, was remelted. The charge of 2,000 lbs. resulting in 1,875 lbs. of good material. Melting loss, 6¼ per cent. The castings were entirely white. 0.4 per cent. of Ferromanganese was added to a quantity of the melt, this, when set, was gray in fracture. Evidently the high silicon in the ferromanganese did it. Another test with this treated material gave a depth of chill of 7-16".

(B) 2,000 lbs. of the worst burnt grate bars were now melted, resulting in a melting loss of 8 per cent. The castings were again white, and this time the addition of 0.4 per cent. of ferromanganese had very little effect on the fracture. Similarly the chill obtained was 12-16".

It is very evident that the ferromanganese, with its high silicon, expended itself in removing the oxidation effects, and could do little in promoting the formation of graphite.

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## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

*The Iron Trade Review*, Dec. 5, 1901.

The regular monthly meeting of the Pittsburg Foundrymen's Association was held Monday evening, Dec. 2. After the

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presentation of a report from Dr. R. G. Moldenke, secretary of the American Foundrymen's Association, on "Melting Loss in Cupola Process," Mr. H. M. Baldwin, of the Power Specialty Co., New York, spoke of the merits of the Bryan vacuum molding machine. One of the machines was on exhibition and its workings were shown. Immediately after adjournment the foundrymen and their friends partook of a lunch provided by the S. Obermayer Co., of Cincinnati, who have recently opened a Pittsburg depot for all kinds of foundry supplies.

Jan 9, 1902.

The regular monthly meeting of the Pittsburg Foundrymen's Association was held Monday night, Jan. 6, at the Association's hall on Sixth avenue. Secretary Zimmers read an announcement of a forthcoming meeting of the New England Foundrymen' Association at Boston, Mass., in which it was stated that the Executive Committee of that organization was already making preparation to entertain the members of the American Foundrymen's Association in Boston in the month of June. The date for the annual convention has not yet been fixed.

S. H. Stupakoff read the second chapter of a serial paper on "The Molding Machine." A paper by John G. Sadlier, of Springfield, O., on "Combustion" was also read and discussed to some extent. The amount of pressure required to melt different grades of iron was considered at length and some of the foundrymen present stated that they have melted all grades of iron with a pressure of five ounces. Others were of the opinion that a higher pressure, ranging from 10 to 14 ounces would be required to melt certain irons, but it was stated that if a blower of proper capacity were secured no such a high pressure would be required.

Feb. 6, 1902.

The regular monthly meeting of the Pittsburg Foundrymen's Association was held at Pittsburg on Monday night, Feb. 3. Paul Kreutzpointner, of Altoona, Pa., presented a paper entitled "What Can Our Schools do for Foundry Apprentices?" which was discussed at length. The meeting was attended by a number of educators, who were very favorably impressed with the efforts of the association to advance technical training among apprentices not only for the foundry, but other industrial institutions. After the meeting a lunch was served.

# PROCEEDINGS OF THE FOUNDRYMEN'S ASSOCIATION OF PHILADELPHIA, PA.

*The Iron Age*, Dec. 12, 1901.

The one hundred and thirteenth regular meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club in that city, Wednesday evening, December 4, 1900. The meeting was called to order at the usual hour, the president, Thomas I. Rankin, occupying the chair. The report of the Treasurer was read, showing a balance on hand of $1,664.-83, with all indebtedness paid. The Executive Committee reported favorable progress on the matter of incorporation of the association. The question of obtaining same under the laws of Pennsylvania or those of Delaware was discussed, and the matter referred back to the committee for further action.

J. S. Stirling, a member of the committee representing the Foundrymen's Association of Philadelphia at the National Reciprocity Convention, held in Washington, D. C., November 19, 1901, made the following remarks in reference to the convention: "The general attitude and results of the National Reciprocity Convention are no doubt familiar to you all. The attendance was representative from the New England, Middle, Southern and Western States, and the discussion was animated, the main points brought out being the recommendation to Congress for a department of Commerce and Industries, to take up this important question, and that the chief of the department be made a member of the President's Cabinet. There was no desire for tariff tinkering, or any means that would disturb the general business conditions, but that unless something was done there would probably develop a condition when the countries to whom we sell our products would ultimately close their doors to us. "Protectionists," Mr. Stirling said, "were out in force and favored reciprocity in all cases where it did not conflict with goods manufactured in this country."

The application of H. C. Haldeman, Pulaski Iron Company, 338 Walnut street, Philadelphia, for membership in the association was read, and, on motion, the secretary was instructed to cast the favorable ballot for membership.

A communication from the McKinley National Memorial

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Association, asking for contributions for their fund, was read, and a motion was made that $100 be contributed. After discussion an amendment to the motion making the amount $50 was offered and accepted, and on a vote of the association the amendment was adopted.

The paper of the evening was then announced, on "Combustion," by J. G. Sadlier of the Springfield Foundry Company, Springfield, Ill., also president of the American Foundrymen's Association.

Considerable discussion followed on the points of the paper, in which Thos. Devlin, D. G. Moore, H. O. Evans, and others took part, at the conclusion of which Mr. Moore moved that a vote of thanks be tendered Mr. Sadlier for his paper, which was adopted.

The secretary then announced that at the January meeting of the association there would be practical demonstrations of both core making and molding machines, and that these would be of particular interest to all foundrymen, after which, on motion, the meeting adjourned.

Luncheon followed as usual. James S. Stirling, acting as toastmaster, called in turn upon T. I. Rankin, P. D. Wanner, O. J. Ward, L. R. Lemoine and A. J. Wright, each responding in an entertaining manner, after which the social session came to a close.

*The Iron Trade Review*, Jan. 16, 1902.

The 115th meeting of the Foundrymen's Association was held at the Manufacturers' Club, in Philadelphia, on Wednesday evening, January 8, the President, Thos. I. Rankin, occupying the chair.

Secretary Howard Evans read a communication from the secretary of the McKinley National Memorial Association acknowledging the receipt of the donation of $50 ordered at the December meeting.

The deferred questions of the incorporation of the association under the laws of the State of Pennsylvania coming up for discussion. P. D. Wanner reported that he had looked into the matter fully and found that he could get a charter for $75. The matter was referred to the Executive Committee for a final report at the next meeting.

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The Secretary introduced Antonio C. Pessano, of the Geo. V. Cresson Co., who had been asked to speak on the work of the New York convention of the National Foundrymen's Association. Mr. Pessano made a very interesting report which we listened to very attentively and produced a lively discussion. The good work of the National Foundrymen's Association was brought out in guarding the financial end of the founders of the country, and Mr. Pessano himself was complimented on the good he had done personally on behalf of the movement.

A paper on "The Stearns Molding Machine and Snap Flask" was read by W. M. Potter of E. C. Stearns & Co., of Syracuse, N. Y. A molding machine was shown in practical operation before the meeting and patterns and castings exhibited.

*The Iron Age*, Feb. 13, 1902.

The regular one hundred and fifteenth meeting of the Foundrymen's Association of Philadelphia was held at the Manufacturers' Club, Broad and Walnut streets, Philadelphia, Wednesday evening, February 5. President Thomas I. Rankin occupied the chair and called the meeting to order at the usual hour.

The reading of the minutes of the previous meeting was dispensed with in the usual manner. The Executive Committee reported that the necessary legal steps were being taken toward the incorporation of the association, and the Treasurer reported a balance on hand amounting to $1,563.30, with all indebtedness paid.

Under new business a letter was read from W. H. Pfahler regretting his inability to be present and to address the association on the subject of "The National Civic Federation."

A paper by J. B. Rufe, subject, "The Rufe Power Molding Machine for General Work," was presented and read by S. C. Bunting, Bryn Mawr, Pa.

Howard Evans then introduced S. Groves of the British Westinghouse Company, Manchester, England. Mr. Groves said that in 1894 he made his first public appearance in this country by reading a paper before the Philadelphia Foundrymen's Association on gear molding and gear molding machinery, and was very glad to be present at this meeting, although not expecting to make any address, as it was his last public appearance

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before going to Manchester, England, to take up his work in connection with the British Westinghouse Company's plant, the general construction of which and the equipment of its foundry plant Mr. Groves briefly described.

The meeting, after tendering a vote of thanks to both Mr. Groves and Mr. Rufe, adjourned, after which the usual luncheon was served.

## PROCEEDINGS OF THE NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

A well-attended meeting of the New England Foundrymen's Association was held at Hotel Essex, in Boston, on Feb. 12th, President Henry A. Carpenter, presiding. After the reading and approval of the minutes, Secretary Fred F. Stockwell reported upon the progress made during the month in the matter of the reception and entertainment of the American Foundrymen's Association, which had accepted the invitation to meet in Boston. From the report made there is every reason to believe that the coming Convention will be the best attended in the history of the organization, and the Foundrymen of New England will give it a royal welcome.

Dr. Richard Moldenke, secretary of the American Foundrymen's Association, was then introduced and read the paper of the evening. It was entitled, "Foundry Economy." An animated discussion lasting nearly two hours followed, and the speaker was honored with a rising vote of thanks. The meeting was adjourned at a late hour.

## DISCUSSION ON THE GRADING OF PIG IRON.

*The Age of Steel.*

Mr. Herbert E. Field adds an interesting paper to the discussion now taking place on this somewhat refractory subject. He says:

For the last five or six years there has been an increasing interest manifested in new methods of mixing iron. Chemistry has slowly but surely gained a foothold in our foundries. Content at first to make the best use of the materials bought by the

old fracture method, the chemist has gradually gained for himself a position in foundry practice where his demands must be regarded in the supplying of iron for foundry use. Various methods of regrading have been suggested, and still the old methods of numbering remain in vogue.

Let us consider briefly the past and present methods of grading pig iron, in order that we may have a thorough understanding of the foundation upon which any new method must rest. At present each of the various grades of pig iron has several different names. These names have come into use during the transition of many furnaces from the old practice of grading by fracture, to the more modern method of grading, to a certain extent at least, by analysis. The original method was to grade iron as No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6, and this is still the custom at most of the charcoal iron furnaces. The coke furnaces, however, have ceased to use numbers to designate the lower grades and have introduced descriptive terms. The grades formerly known as No. 1, No. 2 and No. 3, still retain those numbers, but below that, "Gray Forge," "Mottled," and "White" have replaced the numbers 4, 5 and 6. The No. 1 iron was supposed to be the softest a furnace could produce. By softness, open grain was always meant. No. 2 was the next division by fracture, and so on, down the scale, the closer the grain, the lower the grade. Two pigs cast at the same time, from the same furnace, one in a dry mould and the other in a wet, would produce two grades of iron; and, in spite of the fact that both were identical in composition, one would sell for a higher price per ton than the other. By increasing the size of the pigs and thus producing slower cooling, a furnace would obtain a No. 1 fracture, and consequently a No. 1 price for an iron which their competitor, with smaller pigs, was selling for a No. 2, at a proportionately lower price. In order to designate that their iron was superior in fracture some furnaces early introduced the sign X to indicate a fracture more open than the number to which it was affixed. This change was adopted before chemistry began to figure to any great extent in the grading of pig iron. With the advent of the latter came the discovery, or rather the

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realization, that many of the southern furnaces were producing iron which, although of an inferior fracture, was equal and in many cases superior to the higher fracture grade of the northern furnaces. This led to the adoption of the terms "soft" and "special" as applied to grades of iron. (The term "special," however, has received but limited usage). These terms were used, as were the X's, with grades No. 1 and No. 2. "High Silicon" and "Silvery" were terms introduced at about the same time as No. 1 soft and No. 2 soft. The introduction of these latter terms by southern furnaces, while they may serve to distinguish their grades from the fracture grade of the northern furnaces, has brought about a condition in the purchasing of iron which is often most confusing. The 2X of one furnace frequently coincides in composition with the No. 2 soft of another, yet it is the No. 2 of the northern furnaces which is nearest in fracture to No. 2 soft of the southern furnaces. The No. 2 soft, however, having a much higher silicon, could not be replaced by the No. 2 in mixtures for foundry work. A founder desiring to change from one brand of iron to another, is obliged to go through many trials before he can substitute the old No. 2 for the new No. 2 in his mixture, and feel sure he is not getting into trouble. The introduction of "soft" as a qualifying grade, marks to a certain degree at least, the beginning of grading by analysis. For, while there are at present no definite lines within which the different percentages of silicon, etc., are graded by number or letter, yet this designation indicates that some element other than fracture causes the softness which gives it a name. This element may be clearly shown by contrasting the grades "No. 2 soft" and "No. 1." The No. 2 soft was supposed to fill the place so long held by the "No. 1," but while the "No. 1" relied upon its open fracture for its increased value, the "No. 2 soft" obtained its superior softness through an increase in silicon. Any iron running over 2.75 per cent. in silicon was rated as a "No. 2 soft." Later, irons running over 4 per cent. and under 6 per cent. were called "Silvery," while those running over 6 per cent. were graded as "High Silicon." An increased demand for these two last grades has brought what was formerly considered as "off" products of the furnace, to a position where they command

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a higher prices than is generally paid for No. 1X iron.

Mr. Thomas D. West, in a recent paper, called attention to the wide differences in the analyses of the same grades when produced by different furnaces. He based his criticisms on the analyses furnished to Mr. S. R. Church by the various furnaces for the collection which he has recently published. It is apparent that the furnaces in many cases, in order to make their product appear as favorable as possible, sent in improbable, and in some cases impossible analyses. This paper has served, however, to bring prominently before manufacturers and consumers of pig iron, the necessity for improvement in the grading of iron, for it is chiefly with those grades which are most commonly used that we find the greatest variations. With the high silicon irons we can find little fault in the present methods of grading, for they are rated in proportion to the percentage of silicon. This is true to a certain extent with silvery irons, the percentage of silicon in this grade running from 4 to 6 per cent. In the No. 1 grade it is not possible to even approximate the percentage of silicon, as those furnaces which make a No. 1 iron, sell it entirely by fracture, regardless of analysis, while but a few of the furnaces who sell by analysis make a No. 1 division of their iron. I have known the No. 2 soft and No. 2X grade to include iron running as low as 2¼ per cent. in silicon, and as high as 4½ per cent.; No. 2 irons to run from 1¼ to 3 per cent.; No. 3 as low as 1 and as high as 2½ to 3 per cent.; No. 3 as low as 1 and as high as 2½ per cent.; Gray Forge iron to run from 1 per cent. to 2 per cent., and Mottled irons under 1½ per cent. The wide variation in the No. 2 soft and No. 2 grades which are the ones most commonly used in general foundry work, show how little dependence can be placed on the present methods of grading iron, if bought simply by number. It is very easy to criticise present conditions, but it is much more difficult to bring about an improvement. In the above mentioned paper by Mr. West, he strongly condemns present methods and advocates a radical change in the grading of iron. He suggests the re-numbering of the iron from No. 1 to No. 10, according to the silicon and sulphur percentages. At the Buffalo meeting of the American Foundrymens Association, at which his paper was presented, many letters favorable to this method were read. There were, however, several

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objections suggested which were rather difficult to overcome. I do not believe there is anyone engaged in the use of pig iron who does not consider that there is need of more uniformity in the grading of the different furnaces. While the proposition to grade from 1 to 10 appears at first glance to be a solution of the difficulty, upon further investigation it proves to be so incomplete and impracticable that the writer ventures to predict that it will reach no farther than the state in which it now exists. Mixing by analysis has not, as yet, been adopted by a majority of our foundrymen, both because of the lack of knowledge of the subject, and the difficulty of obtaining that knowledge. Comparatively few of our founders really know what percentage of silicon and sulphur are best suited to their work, and it is not to be hoped that the pig iron merchant is sufficiently educated in metallurgical work to know just what analysis are best suited for the widely varying products of his customers. Again, this method of Mr. West's gets at the difficulty at the wrong end. It proposes to induce the pig iron furnaces to adopt a method of grading which would be unintelligible to the majority of their customers. It is very difficult to force upon the market a product or a method for which there is no demand. It is much easier to create the demand, for then the product will be forthcoming to supply it. How impractical it is for a furnace to regulate its product to such an extent as to bring the grading of its iron down to tenths of a per cent. in silicon is apparent to anyone who has given the matter thoughtful consideration. In regard to sulphur, I have yet to hear of an argument in favor of grading it by West's method. It should be treated as a separate issue and obtained as low as possible in each grade. One furnace by careful management, and selection of ores and coke, can produce an iron with 2½ per cent. silicon, and with but a trace of sulphur, while others find that under the conditions which their furnaces are run, .03 per cent. or even .05 per cent. is the minimum to which they can attain. The amount of phosphorus and manganese which an iron should carry depends upon the class of work for which it is intended. Likewise the sulphur per cent. which a foundry can safely use depends upon the class of work, the kind of fuel, the price and quality of scrap, which local conditions wholly govern. While in the course of

human events great revolutions sometimes occur, and with one stroke overturn and reconstruct, the majority of advancement and lasting improvement is of a gradual, steady kind. It will be so with the question in hand, and if successfully solved, it will be by steady development rather than by the radical change suggested by some writers. In the first place, there is no advantage in adopting any new names for the different grades as, by retaining the old terms, one great cause of confusion would be avoided. Secondly, these terms should be applied to grades which coincide as nearly as possible to the divisions at present in use by a majority of furnaces.

High silicon grades are sold solely by the per cent. of silicon; while silvery, including iron from 4 to 6 per cent. in silicon, well describes and satisfies that grade. No. 2 soft has formerly included iron running up to 4 per cent. silicon. I would suggest the subdividing of this grade, No. 1, to include irons from 3¼ to 4 per cent., while the No. 3 soft embraces the percentages 2.50 to 3¼. From 2 per cent. to 2.50 per cent. could make up the No. 2 division. No. 3 to run from 1.50 per cent. to 2 per cent. No. 4, or "Gray Forge," from 1 per cent. to 1.50 per cent., and No. 5, for Mottled, under 1 per cent. in silicon.

For comparison let me tabulate the present variations together with the suggested grading:

| Present variations. Grade. | Per cent Silicon. | Suggested grading. Per cent Silicon. |
|---|---|---|
| High silicon, | over 6 | over 6 |
| Silvery, | 4 to 6 | 4 to 6 |
| No. 1, | | 3¼ to 4 |
| No. 2 Soft or X, | 2¼ to 4½ | 2.5 to 3¼ |
| No. 2, | 1½ to 3 | 2 to 2.50 |
| No. 3, | 1 to 2.5 | 1.5 to 2 |
| No. 4 or Grey Forge | 1 to 2 | 1 to 1.50 |
| No. 5 or Mottled, | under 1½ | under 1 |

This classification would, with the possible exception of the

No. 1 grade, work no radical change on the present naming or grading. It is sufficiently liberal to be fulfilled by any well-managed furnace.